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The
HARD
RED
SPRING
WHEATS



HARD RED SPRING WHEAT is grown principally in the north-central part of the United States, where the winters are too severe for the production of winter wheat. The States of North Dakota, Minnesota, and South Dakota lead in its production. About 14 million acres of this class of wheat are grown annually in the United States, comprising about one-fourth of the total wheat acreage in the last 10 years.

Hard red spring wheat produces flour of high bread-making quality.

There are 24 distinct varieties of hard red spring wheat commercially grown in the United States. These are known under about 80 different names. Of these the Marquis is the leading variety. Since 1913, when it was first introduced, it has become more widely grown than all other varieties of spring wheat. It has outyielded almost all other varieties, due principally to its earlier maturity, and it excels the other varieties in the quality of its flour.

The Preston (Velvet Chaff) variety yields only slightly less than the Marquis in the Minnesota and Red River Valleys, but considerably less in other sections. The Red Fife and Power varieties are best adapted to northwestern North Dakota and northeastern Montana.

Of the new varieties recently developed, the Kota is the most promising. In North Dakota it has outyielded the Marquis in seasons when rust is prevalent. It is also a good milling and bread-making wheat. It appears, from limited experiments, best adapted to the eastern and southern parts of North Dakota, where stem rust is often a serious factor in wheat production.

In general, the Marquis is the most widely adapted variety of hard red spring wheat.

THE HARD RED SPRING WHEATS.¹

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THE HARD RED SPRING CLASS OF WHEATS.

WHEAT is graded in five classes under the Official Grain Standards of the United States. The first class is designated as Hard Red Spring. About 24 per cent of the wheat acreage of the United States is of this class. The varieties which make up this important class of wheat are distinguished by having hard red kernels and are grown from spring sowing, chiefly in the north-central part of the United States. There are 24 distinct varieties grown, one-third of which are important. Flour of high bread-making quality is manufactured from the principal hard red spring varieties.

WHERE HARD RED SPRING WHEATS ARE GROWN.

The States leading in the growing of the hard red spring wheat varieties are North Dakota, Minnesota, and South Dakota. A considerable acreage also is grown in Montana, Iowa, Illinois, Wisconsin, Nebraska, Washington, and Idaho, and smaller quantities of but little commercial importance in 21 other States. A map of the United States showing the distribution of hard red spring wheat in

¹ The information given in this bulletin is based upon (1) varietal experiments conducted by the Office of Cereal Investigations of the Bureau of Plant Industry, U. S. Department of Agriculture, and the State agricultural experiment stations, either independently or in cooperation; (2) classification studies of all American wheat varieties; (3) a survey of the wheat varieties of the United States, in cooperation with the then Bureau of Crop Estimates, based upon 19,000 returns from 70,000 questionnaires sent to crop correspondents; (4) several years of personal observation of the wheat fields in the States where these varieties are grown; and (5) milling and baking experiments conducted by the Milling-Investigations Section of the Bureau of Markets and Crop Estimates (now a part of the Bureau of Agricultural Economics), in cooperation with the Office of Cereal Investigations, and also by the State agricultural experiment stations.

1919 is shown as Figure 1. Each dot on the map represents 2,000 acres of this class of wheat. A considerable portion of the wheat sown in the eastern and southern sections of the spring-wheat region in 1919 was the result of the war shortage and the guaranteed price, together with unusual success from spring wheat during the previous season of 1918. The acreage shown in 1919, therefore, was somewhat larger than for a normal year, especially in those States outside of the usual spring-wheat region.

AREAS TO WHICH HARD RED SPRING WHEATS ARE ADAPTED.

Hard red spring wheats are best adapted to the northern and colder regions of the United States. In the principal producing

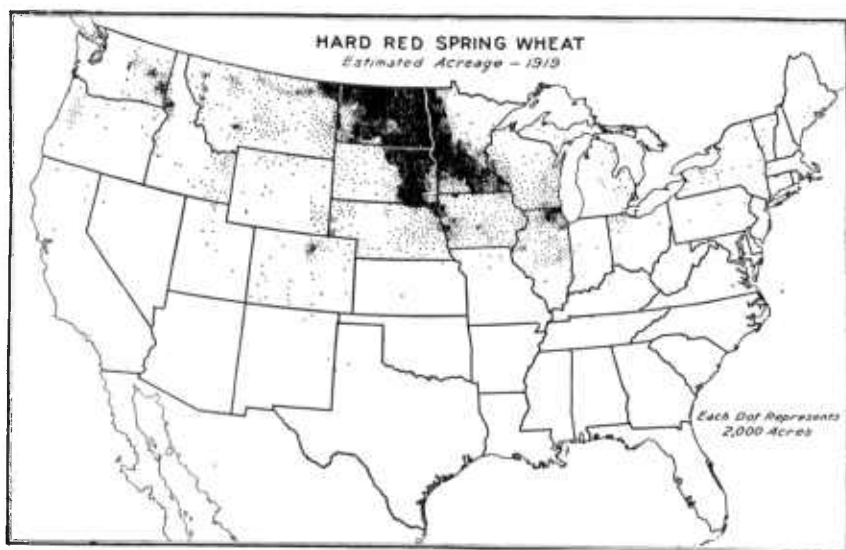


FIG. 1.—Outline map of the United States, showing where hard red spring wheat was grown in 1919. Estimated area, 16,326,800 acres.

area, which includes three States, North Dakota, Minnesota, and South Dakota, the winters are too cold for the production of winter wheat.

Wherever the winters are not too severe, winter or fall-sown wheat is usually more productive than spring wheat. This is due chiefly to the earlier maturity of winter wheat, which enables it partly to escape hot weather, drought, and diseases, and also to the longer growing period of the winter wheat. Spring wheat, therefore, is adapted chiefly to the regions where winter wheat is not successfully grown or where it supplements the growing of winter wheat. In northern areas where both winter and spring wheat can be successfully grown, the growing of both affords a better distribution of

labor and lessens the seasonal risk. Spring wheat is sometimes sown on land in the northern areas where the fall-sown wheat has winterkilled.

In the corn-belt region winter wheat is more productive than spring wheat, but certain hard red spring varieties are much more productive than any other classes of spring wheat. No hard red spring wheat is successfully grown south of the corn belt.

In the northern intermountain region and in the Pacific Northwest certain varieties of hard spring wheat are fairly successful. In most of this region, however, the yields of hard red spring wheats are less than those of winter wheats or certain common and club varieties of white spring wheat. In the irrigated sections of this area hard red spring varieties give comparatively lower yields than on the dry lands. In California and other Southwestern States hard red spring wheats are not adapted and are grown only to a slight extent, usually as winter wheats from fall sowing.

The hard red spring is the most productive class of wheat in Minnesota and Wisconsin and in the New England States. In the eastern parts of North Dakota and South Dakota and in the northern Great Plains area the durum wheats yield somewhat more than the best hard red spring varieties, principally because of their greater resistance to drought and to stem rust. In favorable years, however, the leading hard spring varieties yield nearly as well as the durum varieties grown in these regions. The higher price which often prevails for the hard red spring wheat makes the net returns per acre from hard spring wheats in this region nearly as much as from the durum varieties. There is usually greater domestic demand for hard red spring wheat than for wheat of other classes, because of the high quality of flour it produces.

In general, the hard red spring wheats are best adapted to the more concentrated areas as shown on the map (Fig. 1). In the northern Great Plains area, where the durum wheats outyield the hard red spring varieties, the class of wheat grown will largely depend upon the relative market price of each.

VARIETIES.

There are 24 distinct varieties of hard red spring wheat commercially grown in the United States, known under about 80 different names. Several additional varieties are being grown experimentally which have not been distributed to farmers.

The varieties of hard red spring wheat differ widely in their yielding ability, rust resistance, earliness, and milling and baking value, as well as in their external structure and appearance. Some

varieties of similar appearance differ in origin and adaptation. For convenience in discussion the varieties of hard red spring wheat are divided into five sections on the basis of head and chaff characters.

DISTINGUISHING CHARACTERS AND VARIETIES OF HARD RED SPRING WHEAT.

SECTION 1.—Heads beardless; chaff glabrous (not velvety), white or yellow:
Marquis, Red Fife, Power, Glyndon, Wellman, Ghirka, Kitchener,
Red Bobs, Ruby, Kinney, Huston.

SECTION 2.—Heads beardless; chaff velvety, white or yellow:
Haynes Bluestem, Dakota.

SECTION 3.—Heads bearded; chaff glabrous (not velvety), white or yellow:
Preston (Velvet Chaff), Java, Kota, Converse, Champlain, Dixon,
Fretes, Chul.

SECTION 4.—Heads bearded; chaff glabrous (not velvety), brown or red:
Ladoga.

SECTION 5.—Heads bearded; chaff velvety, white or yellow:
Prelude, Humpback.

SECTION 1.—HEADS BEARDLESS; CHAFF GLABROUS (NOT VELVETY), WHITE OR YELLOW.

The varieties of this section are the most extensively grown of the hard red spring wheats. They are similar in appearance, and most of them are closely related. The heads are beardless and slender to midstout. In general, they vary in length from 3 to 3½ or 4 inches. The chaff is white and glabrous (not velvety or hairy) and the kernels are rather short and small to midsized, have an angular or irregular appearance, are very hard, and mostly of a dark red color. The commercial varieties in this section are described and discussed in the following paragraphs, the most important being listed first.

MARQUIS.

The Marquis is the most important variety of hard red spring wheat. Although it has been grown in the United States only since about 1913, it is now the leading spring-wheat variety, and is exceeded in acreage by only one variety of winter wheat. Approximately 11,800,000 acres of Marquis wheat were grown in the United States in 1919.

The Marquis variety has rather short straw, heads, chaff, and kernels. It matures fairly early, which sometimes enables it partly to escape rust and drought. Like all varieties in this section, it has beardless heads, smooth white chaff, and red kernels (Fig. 2, A). The chaff is rather firm, so the heads are not easily shattered.

Marquis is a selection from a hybrid produced by crossing a hard red wheat from Calcutta, India, and the well-known Red Fife. The cross was made by Dr. A. P. Saunders about 1892. The Marquis

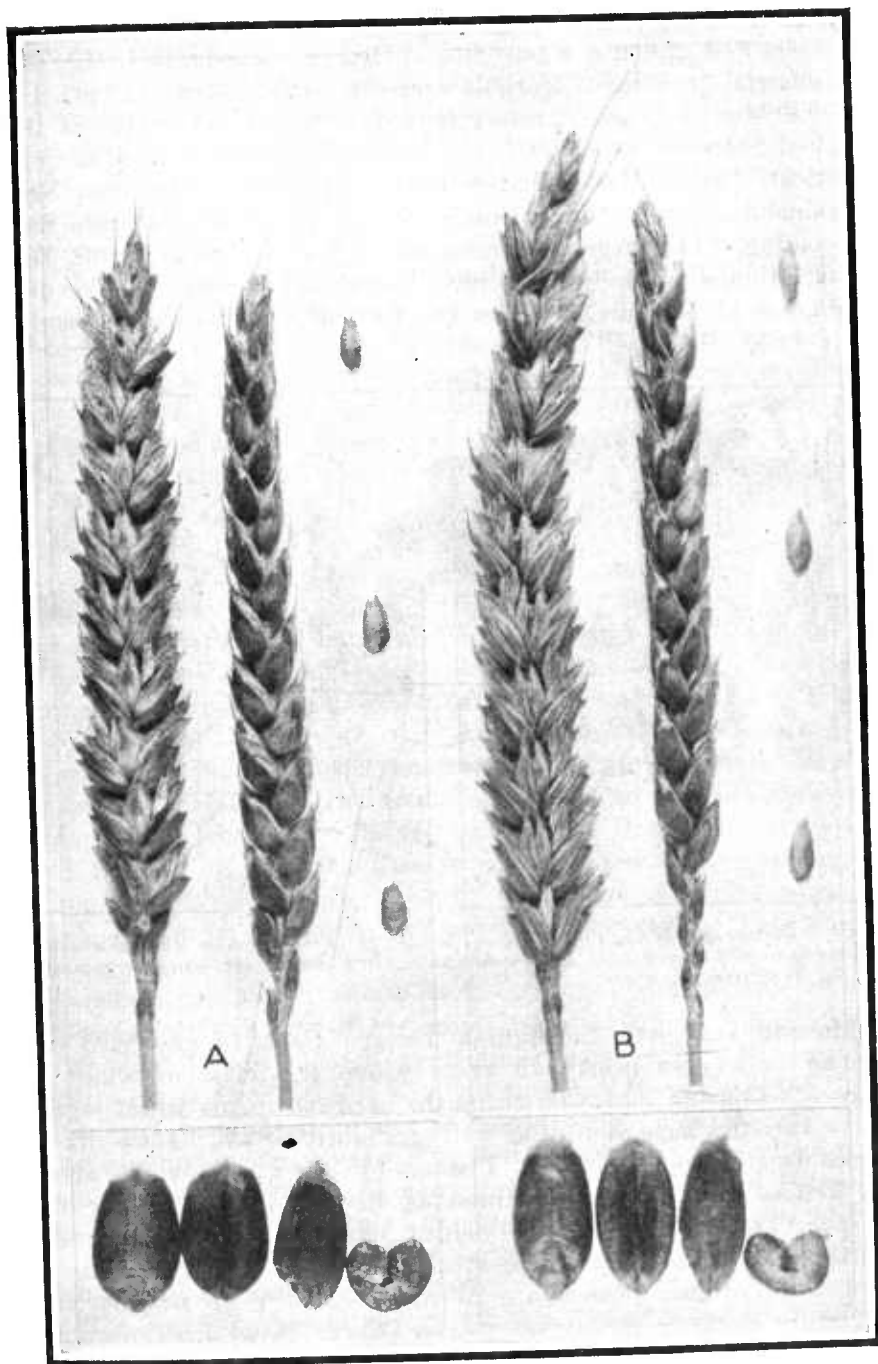


FIG. 2.—Heads, chaff, and kernels of Marquis (A) and Red Fife (B) wheats. Heads and chaff, natural size; kernels, magnified 3 diameters.

was selected and named by Dr. C. E. Saunders, Dominion Cerealist, and was first grown as a pure line at Ottawa, Canada, in 1904. The commercial growing of Marquis wheat in Canada began in 1909.

The Marquis variety was reported grown in 38 States in the United States in 1919. It is the leading variety of wheat in Connecticut, Idaho, Maine, Massachusetts, Minnesota, Montana, New Hampshire, North Dakota, South Dakota, Vermont, Wisconsin, and Wyoming. The largest acreages are in North Dakota, South Dakota, Minnesota, Montana, Illinois, Iowa, and Wisconsin. The distribution of Marquis wheat in the United States is shown on the map (Fig. 3).

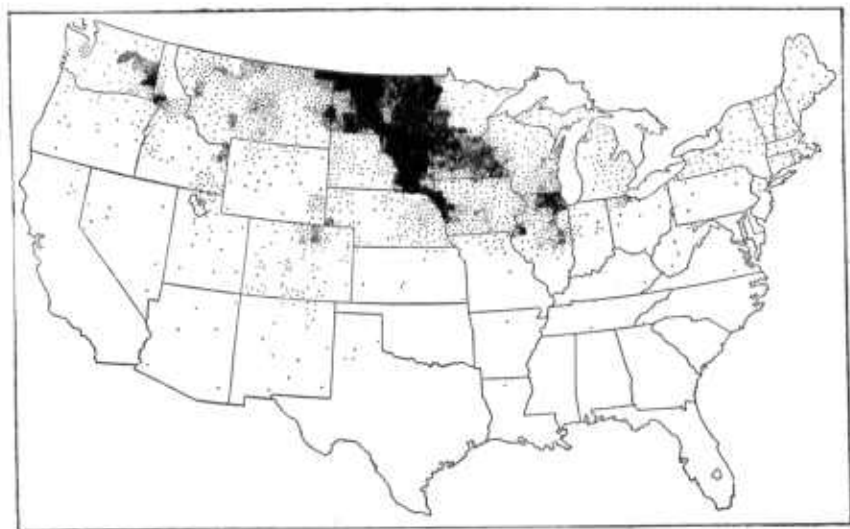


FIG. 3.—Outline map of the United States, showing the distribution of Marquis wheat in 1919. Each dot represents 1,000 acres or fraction thereof per county. Estimated area, 11,825,000 acres.

Marquis has given the highest average yields of any hard red spring variety in nearly all areas where this class of wheat is grown. In a few localities within the hard red spring-wheat region other varieties have yielded as well or slightly better. These differences usually are only local. Preston (Velvet Chaff) yields about as well as Marquis in the Minnesota River Valley of Minnesota. Power (Power's Fife) has outyielded Marquis in the northwestern corner of North Dakota and the adjoining portion of Montana, and it also often is preferred to Marquis because it grows taller and therefore is easier to harvest. Java (Early Java) has sometimes equaled the Marquis in yield in Iowa and northern Wisconsin, but

this variety has much softer grain than Marquis. Owing to the superior quality of Marquis it is doubtful whether these other varieties can be more profitably produced even in these sections.

Marquis wheat is not well suited to growing on poor soil, and it will not resist rust. On the whole, however, if the entire acreage now devoted to the growing of hard spring wheat were sown to this variety, the production of this crop would be considerably increased.

Marquis when grown under favorable conditions produces a plump kernel which yields a good percentage of flour. It is equal or superior to all other hard red spring wheats in this respect. In the quality of its flour for bread making the Marquis excels all other varieties of hard red spring wheat which are now commercially grown in the United States. The bread produced from this wheat has a large expansion and an excellent texture and color.

RED FIFE.

The Red Fife variety (known also as Canadian Fife, Fife, Saskatchewan Fife, and Scotch Fife) differs from Marquis in being somewhat taller and later and having longer heads and kernels. Red Fife is shown in Figure 2, *B*. The original Red Fife wheat is supposed to have come from Poland or Russia by way of Germany and Scotland. About 77 years ago David Fife, of Otonabee, Ontario, Canada, received a small sample of wheat from a friend in Glasgow, Scotland. The friend had obtained the sample from a shipload of wheat from the German port of Danzig, but supposedly of Russian origin. Mr. Fife sowed the wheat in the spring, but it proved to be a winter wheat. One plant of spring wheat developed, however, which was saved and increased. This was the beginning of the Red Fife wheat, which became widely grown in Canada. Samples of wheat identical with Red Fife were received independently in 1904 from Galicia (now a part of Poland) by the Canadian Department of Agriculture and the United States Department of Agriculture. The cultivation of Red Fife in the United States began in 1860. Prior to the introduction of Marquis it was our leading spring wheat. The Red Fife variety was often grown and distributed under the names of growers. Most of these were only similar pure stocks of this variety, but from them were developed several distinct strains, formerly of considerable importance, which will be discussed later.

The Red Fife variety was grown in 22 States in the United States in 1919. It is most widely grown in Minnesota and the Dakotas. A map of the United States showing the distribution of Red Fife combined with that of Power and Glyndon wheat is shown as Figure 4.

Red Fife largely has been replaced by Marquis owing to the earlier maturity and superiority of the latter, and it could doubtless be further replaced with profit. In the northwestern portion of North Dakota and the northeastern portion of Montana, where stem rust rarely occurs, Red Fife and the strains originated from it are about equal in yield to Marquis and because of being slightly taller are easier to harvest in dry seasons and are preferred by some growers. Outside of this region the Marquis variety as a rule should be grown in preference to Red Fife.

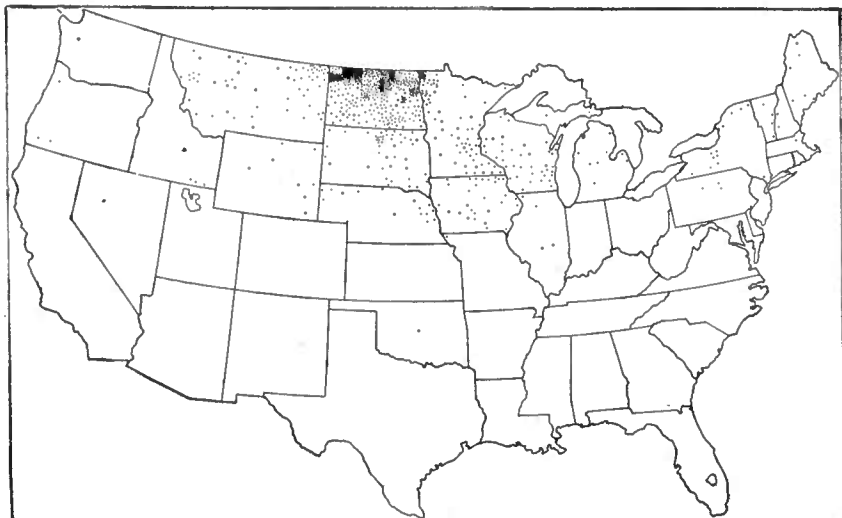


FIG. 4.—Outline map of the United States, showing the distribution of Red Fife wheat in 1919. Each dot represents 1,000 acres or fraction thereof per county. Estimated area, 748,000 acres.

Red Fife, although formerly one of the best wheats for bread making known, is somewhat inferior to Marquis and probably also to several other varieties recently developed.

POWER.

Power (Power's Fife) is practically identical with Red Fife, although in the length of head and kernel it is shorter and very similar to Marquis. The original Power's Fife was developed from a single plant found growing in an oat field by James Holes, of Fargo, N. Dak., about 1885. Some of this seed was obtained by J. B. Power, of Power, N. Dak., who increased it and distributed it in large quantities under the name Power's Fife. The North Dakota Agricultural Experiment Station, which grew this wheat under the designation of Station No. 66, made some selections from it and distributed one of them from the Williston substation as Power or North Dakota No. 313, which is the origin of most of this variety now grown.

Power is commercially grown only in North Dakota and Montana. The extent of its distribution is not definitely known, owing to its confusion with other Fife wheats.

In varietal experiments Power has produced somewhat higher yields than Red Fife in nearly all portions of the hard spring-wheat region. It has exceeded Marquis in yield only in the northwestern portion of North Dakota and the northeastern portion of Montana. Milling and baking experiments have shown that Power is slightly inferior in milling and baking value to Red Fife and consequently considerably inferior to Marquis.

GLYNDON.

Glyndon (Minnesota No. 163) differs from the Red Fife and Power varieties principally in having longer and more open heads. The kernels also are slightly longer. This strain of Red Fife dates from about 1891, when it was first grown by the Minnesota Agricultural Experiment Station as No. 811 at the Glyndon substation in western Minnesota. In the burning of the Glyndon station buildings all records of its origin were lost. Without doubt it is one of the many samples of Red Fife obtained from Minnesota farmers in 1888 and 1889. A selection of this Glyndon No. 811 made in 1892 was widely distributed in 1898 by the Minnesota Agricultural Experiment Station as Minnesota No. 163, but in 1915 the name Glyndon was assigned to it by the Minnesota station.

Glyndon is still grown to some extent in Minnesota, North Dakota, and South Dakota. Previous to the distribution of Marquis it was an important variety in Minnesota.

The yields of Glyndon usually have been less than those of Red Fife and Power in the Dakotas, but in Minnesota Glyndon has yielded as well or better than the other Fife strains. Owing to the larger yields of Marquis, however, Glyndon has nearly disappeared from cultivation. In milling and baking value Glyndon is inferior to Marquis, and it is slightly inferior to Red Fife and Power in the percentage of flour produced, but in bread making Glyndon consistently produces a much larger loaf than Power.

WELLMAN.

Wellman (Wellman's Fife) differs from Glyndon in being slightly taller and in having a longer and more open head and a shorter and softer kernel. This variety was developed by D. E. Wellman, of Frazee, Becker County, Minn., from a plant selected from Red Fife wheat which he called "Scotch Fife." The original sample of Scotch Fife was a mixture and had been obtained from the "Saskatchewan Valley" in Canada. The Wellman strain, however, is identical with an older variety called White Russian, which apparently was mixed with the sample of Scotch Fife grown by Mr. Wellman.

Wellman formerly was grown in considerable quantities, especially in Minnesota and North Dakota and also in the New England States, but it now has almost disappeared from cultivation. There apparently is still a small acreage grown, especially in New England, as it was reported from Aroostook County, Me., in 1919.

In many experiments with Wellman conducted in the United States and Canada a number of years ago this variety was almost invariably exceeded in yield by Red Fife. Wellman also has softer kernels than most of the hard spring wheats, which would indicate that it is of lower milling and baking value. The growing of this variety, therefore, should be discontinued.

GHIRKA.

Ghirka (Ghirka Spring, known also as Early Russian, Russian, and Russian Fife) differs from the true Fife strains in having a longer and more tapering spike and larger and softer kernels. The straw or ripe stem usually is tinged with purple. It is slightly earlier than Red Fife.

Ghirka was an important variety in Russia, grown principally in southern Russia and the Volga River district, when it was introduced into the United States. During the period from 1898 to 1904, inclusive, eight lots were obtained by the United States Department of Agriculture. Other importations were made by Russian immigrants. Joseph Dukart, who settled at New England, N. Dak., brought a 2-pound lot from Russia in 1905. From the increase of this, several thousand acres were grown in western North Dakota from 1914 to 1916. Owing to the phenomenal success of Marquis, the Ghirka is now grown only sparingly in North Dakota, South Dakota, and Wyoming. On the farms it is best known as Russian or Russian Fife.

Ghirka is quite drought resistant and will often yield well in dry seasons in the northern Great Plains area. In general, however, the yields of this variety have been less than those of Marquis.

Ghirka has a softer kernel than almost all other varieties of hard spring wheat and is of comparatively low milling value. It is much inferior to Marquis in the percentage of flour obtained from the wheat and somewhat inferior in the quantity and quality of the gluten. The growing of Ghirka should be entirely discontinued.

KITCHENER.

Kitchener differs from Marquis in being slightly later and taller and in having a purple straw and a slightly longer kernel. The chief difference, however, is the tip of the head of Kitchener, which is square or swollen (Fig. 5, B) instead of pointed like that of Marquis.

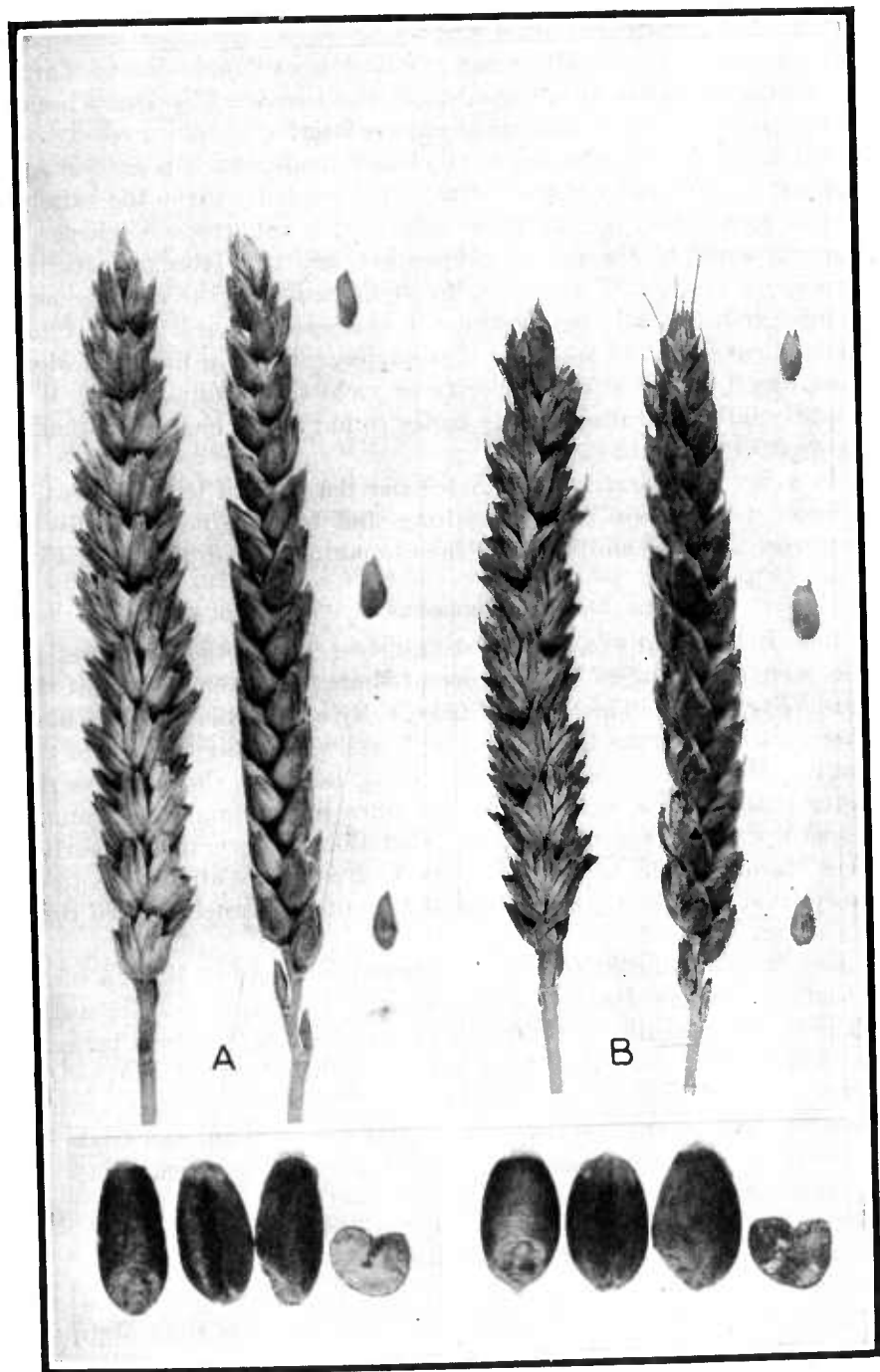


FIG. 5.—Heads, chaff, and kernels of Red Bobs (A) and Kitchener (B) wheats. Heads and chaff, natural size; kernels, magnified 3 diameters.

Kitchener originated from a head of wheat found in a field of Marquis in 1911, by Dr. Seager Wheeler, at Maple Grove Farm, Rosthern, Saskatchewan, Canada. It was increased by Dr. Wheeler and distributed about four or five years later.

Kitchener is grown to some extent in Canada, but it is not yet important in the United States. Due to the publicity given the variety, it has been tested by many farmers in this country. Kitchener is scarcely equal to Marquis in any respect, and it is later in maturing and more susceptible to injury by stem rust. In the eastern more humid and rust-affected section of the spring-wheat area it has yielded considerably less than that variety. Only in northern Montana has it shown any superiority in yield to Marquis, and as it is slightly taller and thus usually easier to harvest it has some promise for that dry section.

In a few comparative tests Kitchener has proved to be somewhat inferior to Marquis in both milling and baking qualities. It is, however, a better milling and bread-making wheat than the Fife strains.

RED BOBS.

Red Bobs usually can be distinguished from other varieties in this section because of the absence of short beards on the tip of the head (Fig. 5, 4). The heads of practically all beardless wheats have short beards, varying from $\frac{1}{4}$ to 1 inch in length, near the tips of the heads. Most of the heads of Red Bobs, however, do not have the short beards. The variety was not pure in this and other minor respects when it was distributed. Red Bobs is several days earlier than Marquis. The kernels of the two varieties are almost identical, except that the brush (the hairs on the tip of the kernel) of Red Bobs is shorter.

Red Bobs originated from a head found in a field of Bobs, a white wheat, in 1910, by Dr. Seager Wheeler, at Rosthern, Saskatchewan, Canada. It probably is the result of a natural field hybrid between Bobs and Marquis. Red Bobs was first distributed in 1918. As yet it is grown only to a limited extent in the United States, having been introduced but recently. The early experiments and trials by farmers have shown that it is very susceptible to stem rust and adapted only to the northern and drier sections of Montana, where rust does not occur.

In experiments in central and northern Montana Red Bobs has outyielded Marquis during the past two years. Under conditions of extreme drought Red Bobs is likely to yield more than Marquis, owing principally to its earlier maturity. Where rust is likely to occur, however, as in Minnesota and the Dakotas, Red Bobs should not be grown, as usually it yields much less than Marquis.

Red Bobs is a good wheat for milling and baking. In yield of flour it is nearly equal to Marquis when grown under the same conditions. The quality of Marquis flour, however, is superior to that of Red Bobs. The former as a rule has a higher protein content and produces a larger loaf of bread.

RUBY.

Ruby is about five days and sometimes a week earlier than Marquis. It also can be distinguished from Marquis by the purple straw at maturity. The grain of the two varieties can scarcely be distinguished.

Ruby was originated by Dr. C. E. Saunders, Dominion Cerealists, at the Central Experimental Farm, Ottawa, Canada. It is the result of a cross between Red Fife and a hybrid wheat known as Downy Riga. It was first distributed in 1917.

Ruby was grown to a slight extent in North Dakota in 1921 from seed imported from Canada. As a rule it has produced low yields and is distinctly inferior to Marquis in this respect. In a few instances the early maturity of Ruby enabled it partly to escape drought and to yield as well as Marquis, but in these cases all wheats yielded low. Unless future trials with this variety show it to be more promising than past results have indicated, it should not be distributed further in the United States.

KINNEY.

Kinney (known also as Noah Island, Odessa, and Surprise) is classed as a hard red spring wheat, although it differs widely from the varieties so far discussed. It is a late wheat, having square heads and rather a soft, wide kernel. The stems and leaves of this variety have a distinct bloom or white waxy covering (such as occurs on sorghums, plums, etc.) just before ripening.

Kinney was introduced into the Willamette Valley of Oregon from France during the late sixties or early seventies by Albert Kinney, who at that time was associated with his father in the milling business. It was distributed by Mr. Kinney to farmers in the vicinity of the mill.

Kinney, as far as known, is grown only in six counties in the Willamette Valley of Oregon, where it is sown in both spring and fall. It is not grown in the northern hard spring-wheat region, and because of its late maturity it is not adapted there. Kinney is one of the leading varieties of wheat in the district where it is grown, but experiments have shown its yields to be less than those of several other varieties. Outside of this humid section of Oregon Kinney is not adapted.

Early experience with Kinney proved it to be of rather low milling value, and in this respect it is inferior to most other hard spring varieties.

HUSTON.

Huston (known also as Bulgarian, Early Wonder, Grass, Little Red, Ninety-Day, Red Spring, and Swamp) differs from most other varieties included in section 1 of this bulletin in having small heads and rather soft kernels. The straws show a faint tinge of purple at maturity. The kernels show a characteristic pit or opening in the crease.

Huston was obtained by a Mr. Belshaw in 1876 from the Centennial Exposition, Philadelphia, Pa., where it was on exhibition as Bulgarian Red Spring. It was introduced into the vicinity of Eugene, Oreg. After increasing the seed the crop was given to a Mr. Huston, who grew and distributed the variety.

Huston now is grown only in seven counties in western Oregon, and apparently it has not been successful or not tried elsewhere. None of it is grown in the northern hard spring-wheat region. This variety succeeded well on the foothill lands in the Willamette Valley of Oregon and has been one of the best spring wheats for that district. It is doubtful, however, whether it is equal to Marquis for this and other sections. The milling and baking value of Huston is inferior to Marquis and to most other hard spring varieties.

SECTION 2.—HEADS BEARDLESS; CHAFF VELVETY, WHITE OR YELLOW.

The wheats of this section, known as the Bluestem group, are identical in appearance and very similar in yield and quality. They are hard red spring wheats and greatly different from the varieties called Bluestem in the eastern, southern, and western parts of the United States. The varieties differ from those in section 1 of this bulletin in having velvety chaff and the heads slightly longer and broader. The heads also shatter more easily when fully ripe.

The kernels of the Bluestem wheats are slightly longer, have longer hairs on the tips than the Fife varieties, and have rounded rather than sharp edges. The grain is hard and red, although not quite as hard as some of the wheats included in section 1. The varieties are from 3 to 10 days later in maturity than Marquis and very susceptible to stem rust.

These varieties originated from a wheat which is reported to have been grown in the eastern United States as a winter wheat as early as 1855. This so-called Bluestem became a leading variety in the northern spring-wheat region by 1890, but much of it was replaced later by selected strains.

HAYNES BLUESTEM.

The name Haynes Bluestem is now applied to the original Bluestem as well as to the selected strain known as Haynes Bluestem. Other names applied to the variety are Bolton Bluestem, Marvel Bluestem, Minnesota No. 169, and Velvet Bluestem. This variety has all the characteristics previously mentioned for the Bluestem group, viz, large beardless heads, velvety white chaff, rounded hard red kernels, easy shattering, and late maturity (Fig. 6).

Haynes Bluestem was selected from the bulk Bluestem variety in 1883 by L. H. Haynes, of Fargo, N. Dak. This wheat was first distributed about 1892 and soon became widely grown in Minnesota and the Dakotas. Selections from this wheat made at the Minnesota Agricultural Experiment Station were increased and distributed by that station during the late nineties as Minnesota No. 169 or Haynes' Pedigreed Bluestem.

Haynes Bluestem, under one or another of its names, is grown to a considerable extent throughout the northern spring-wheat region. About 1,500,000 acres of this variety were grown in 1919 (Fig. 7). It was formerly considered a high-yielding variety in Minnesota and the eastern Dakotas. In

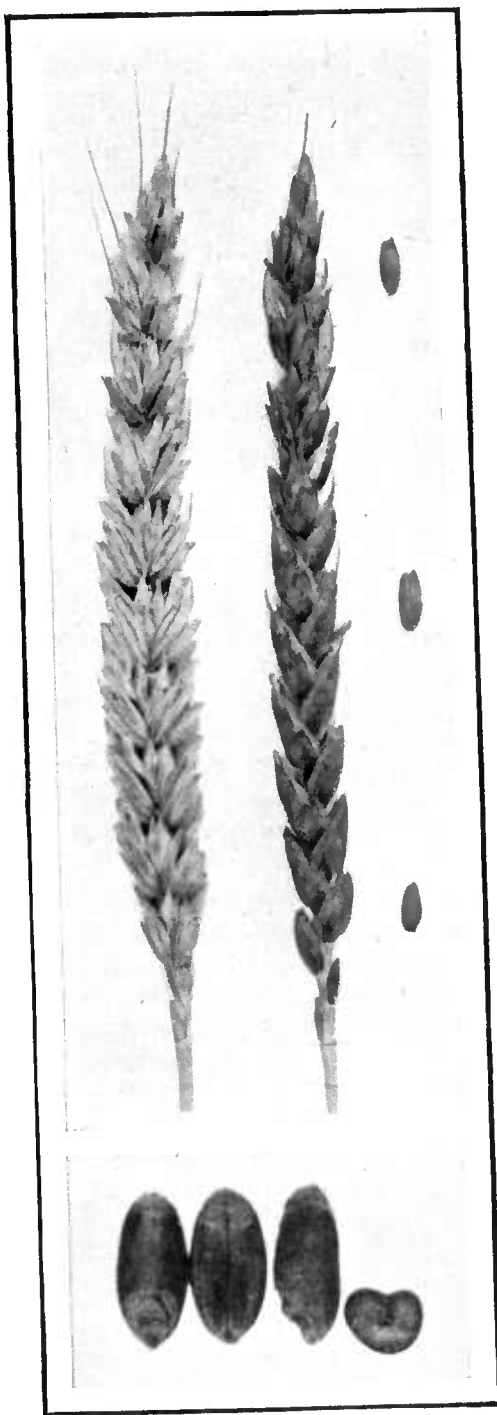


FIG. 6.—Heads, chaff, and kernels of Haynes Bluestem wheat. Heads and chaff, natural size; kernels, magnified three diameters.

variety in this section is Preston, which commonly is called Velvet Chaff.

PRESTON.

Preston (Velvet Chaff, known also as Bearded Fife, Blue Ribbon, Climax, Golden Drop, Johnson, Johnson's Early Fife, Minnesota No. 188, and Red Fife) has bearded, tapering heads about $3\frac{1}{2}$ to 4 inches long and mid-sized hard red kernels. The kernel can be distinguished from that of the wheats of the Fife and Bluestem groups by the dull-red color and the rather narrow V-shaped crease. Preston matures in about the same length of time as Red Fife, being a few days later than Marquis. A spike, glumes, and kernels of Preston are shown in Figure 8, A.

Preston was developed from a cross between Ladoga and Red Fife made by Dr. William Saunders at the Central Experimental Farm, Ottawa, Canada, in 1888. After being selected, this wheat was distributed in Canada and also sent to the Minnesota Agricultural Experiment Station in 1896, from which station it was later distributed to farmers of that State as Minnesota No. 188. Other similar wheats, called Johnson and Golden Drop, which can not be distinguished from Preston, were grown in the United States prior to this introduction of Preston. These wheats, however, were not pure, as they contained other types, and the name Johnson had sometimes been used for the Java variety. Java also contained mixtures similar to Preston. The exact origin of the spring wheat commonly called "Velvet Chaff" in this country is somewhat uncertain, therefore, although it is identical with the Preston wheat of Canada.

No other definite history is known for Velvet Chaff, and it is believed by the writers to be principally the Preston variety. In Wisconsin this same wheat is sometimes grown under the name Blue Ribbon.

Preston (or so-called "Velvet Chaff") is grown throughout almost the entire northern spring-wheat region. The sections of heaviest production are the Red River and Minnesota River Valleys. This distribution is shown on the map (Fig. 9). It is estimated that 2,245,200 acres were grown in 1919.

In most of the northern spring-wheat region Preston has given lower average yields than Marquis. This is true of the entire Great Plains area as well as much of the more humid eastern portion of the spring-wheat region. In the Red River Valley of Minnesota and North Dakota and in the Minnesota River Valley of Minnesota Preston has yielded nearly as high as Marquis and occasionally higher than that variety. In general, however, Marquis has given higher yields. Outside of these sections, where Preston is best adapted, it yields considerably less than Marquis and could be profitably replaced by that variety.

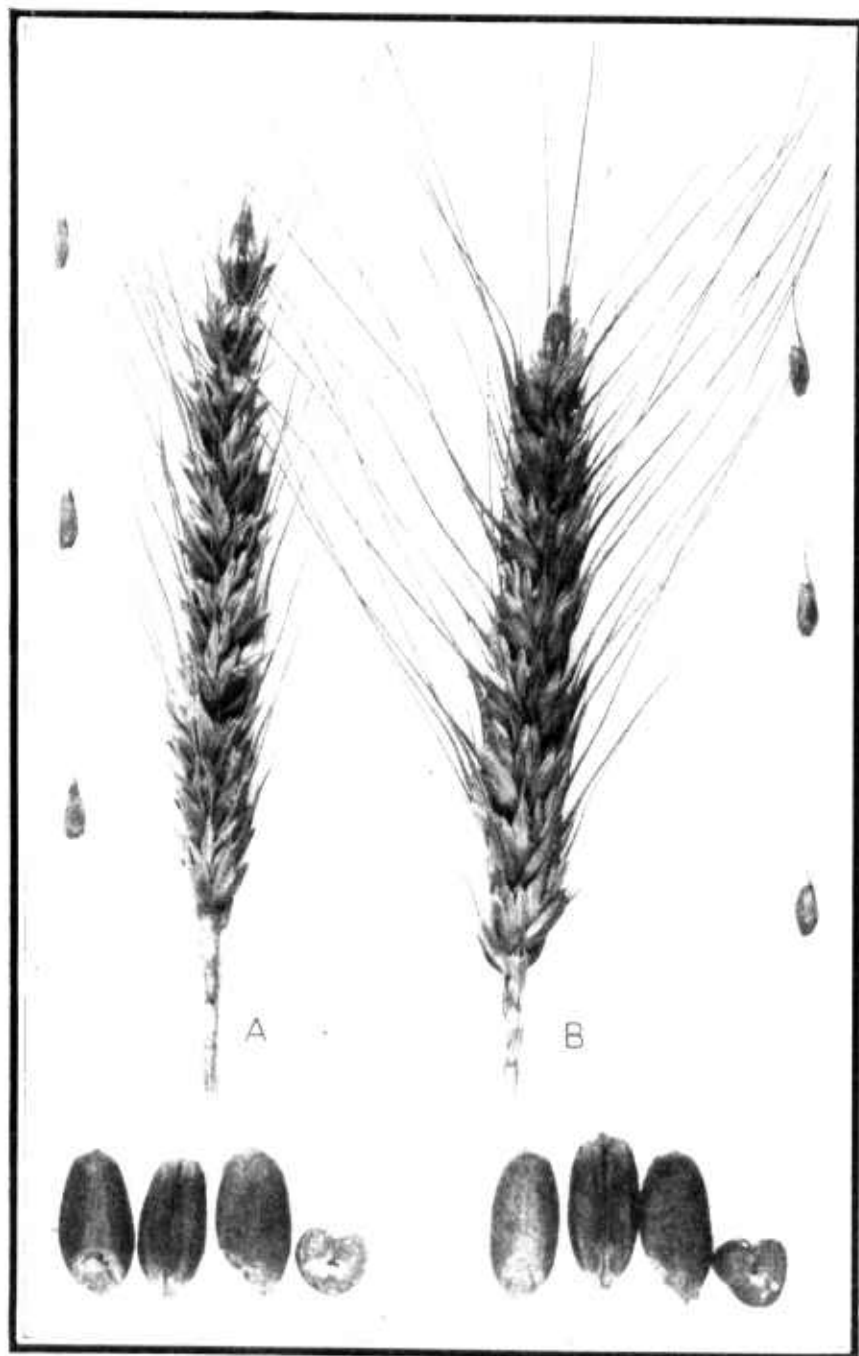


FIG. 8.—Heads, chaff, and kernels of Preston (A) and Kota (B) wheats. Heads and chaff, natural size; kernels, magnified 3 diameters.

Preston produces a plump kernel which under average conditions weighs about $1\frac{1}{2}$ pounds per bushel more than Marquis grown in the same locality. This is not true under very favorable conditions, however. Nevertheless, the heavier bushel weight frequently results in a higher market grade for Preston. Owing partly to its high bushel weight Preston usually produces a larger percentage of flour than Marquis. The variety, however, is inferior to Marquis in protein content and in baking quality, though experiments show it to be about equal to Red Fife and Haynes Bluestem in these characters.

JAVA.

Java (Early Java, known also as Black Tea, China Tea, Early Iowa, Siberian, Swedish, and Tea Leaf) is a mixture of several kinds. Within

this variety are found both white and brown chaff, soft and hard kernels, and other minor variations. The heads are bearded and usually have white chaff and semihard red kernels. As a rule the kernels are softer than those of Preston. Java is a few days earlier than that variety. Most of the heads of Java have longer "beaks" (points on the outer chaff of each spikelet, or mesh) than Preston.



FIG. 10.—Outline map of the north-central United States, showing the distribution of Java wheat in 1919. Each dot represents 1,000 acres or fraction thereof per county. Estimated area, 55,000 acres.

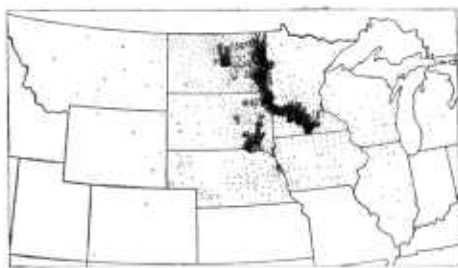


FIG. 9.—Outline map of a portion of the United States, showing the distribution of Preston wheat in 1919. Each dot represents 1,000 acres or fraction thereof per county. Estimated area, 2,245,200 acres.

Java is probably one of the oldest spring varieties grown in the United States. Siberian (a variety identical with Java) was reported grown as early as 1837. China Tea (identical with Java) has been grown in New York since 1845. Early Java was first reported from Nebraska in 1899. It was advertised and distributed in 1900 and later as an early spring wheat by Wallaces' Farmer, of Des Moines, Iowa.

Java is grown in Illinois, Iowa, Nebraska, New York, and Wisconsin. It is most important in Nebraska and Iowa, but only a small acreage of this variety is grown in the United States. Its distribution is shown in Figure 10.

Java has given fair yields in central Iowa and northern Wisconsin owing to its earliness, which enables it partly to escape rust and hot weather. Even in these sections it is usually outyielded by Marquis and should be replaced by that variety.

Being a mixture of different strains, mostly of rather soft wheat, Java is inferior to most other hard red spring-wheat varieties for milling and bread making.

KOTA.

Kota is resistant to the forms of black stem rust (*Puccinia graminis*) that predominate in the northern spring-wheat region. It, however, is susceptible to the less damaging orange leaf rust (*Puccinia triticea*). Aside from its resistance to stem rust Kota differs from Preston in having longer beaks and a more elevated shoulder on its outer glumes. The beaks of Kota average about $\frac{1}{2}$ inch long, while those of Preston average only about $\frac{1}{8}$ inch in length. The Kota has a slightly weaker straw and is more easily lodged than Preston, and the kernels are longer, harder, and more angular. A spike, glumes, and kernels of Kota are shown in Figure 8, B.

The original seed was obtained in Russia in 1903 by Prof. H. L. Bolley, of the North Dakota Agricultural College, while making a study of the flax industry of Europe for the U. S. Department of Agriculture. In the years immediately following its introduction, this wheat was not known to have any special merit. After the rust epidemic of 1916, mixtures of it in Monard durum wheat were separated, found to be resistant to some forms of stem rust and to have good agronomic and milling values, and the variety was named Kota by L. R. Waldron,² of the North Dakota Agricultural Experiment Station, and J. A. Clark, of the U. S. Department of Agriculture. The commercial production of Kota was begun in 1919, and it is now grown to a limited extent in North Dakota.

The early and limited experiments with Kota have shown, because of its resistance to stem rust, that it is able to yield well under rust conditions. Under favorable conditions Marquis and sometimes other varieties of hard spring wheat have outyielded Kota. Because of its weak straw and consequent tendency to lodge, this variety apparently is not well suited to rich moist lands or to the conditions prevailing east of the Red River Valley of Minnesota. It is fairly successful under conditions of severe drought. The early experiments indicate, however, that it is best adapted to eastern and southern North Dakota, where it has outyielded Marquis from 1 to $4\frac{1}{2}$ bushels per acre. In years when stem rust is an important factor in influencing yields Kota probably will outyield all varieties of hard red spring wheat and some varieties of durum wheat.

Kota is a very good milling and bread-making wheat. It has a higher percentage of gluten and flour yield and is outstandingly su-

² Waldron, L. R., and Clark, J. A. Kota, a rust-resisting variety of common spring wheat. In Jour. Amer. Soc. Agron., v. 11, no. 5, p. 187-195. 1919.

perior to other varieties in water absorption. When grown under normal conditions it usually is slightly inferior to Marquis in baking qualities but is equal or superior to any other variety of hard red spring wheat. Under rust conditions Kota produces a plumper and heavier kernel than other hard red spring varieties and is of even better milling and baking quality than Marquis similarly grown.

CONVERSE.

Converse (Red Russian) differs from Preston in being taller and earlier and in having longer beaks and somewhat softer kernels, which are more angular than those of Preston.

The origin of Converse is not known. It was first obtained from Wyoming by the Bureau of Plant Industry, U. S. Department of Agriculture, in 1908. On farms this wheat is known as Red Russian, but it recently has been named Converse because of its discovery in Converse County, Wyo.

Converse is now grown to a small extent in western Nebraska and eastern Wyoming. In northeastern Colorado and southeastern Wyoming this variety has given yields about equal to those of Marquis. It has not shown much promise in other sections where it has been tested, and doubtless it should be replaced by Marquis in the districts where it is now grown.

A limited number of tests with Converse have shown it to be inferior to Marquis and several other varieties of hard red spring wheat in milling and baking quality.

CHAMPLAIN.

Champlain (known also as Pringle's Champlain or Pringle's Champion) has short, wide, semihard, red kernels which are distinct in having a collar or rim around the border of the tuft of hairs, or brush, at the upper end of the grain. The lower leaves of Champlain are also distinct in being quite hairy.

This wheat was produced from a cross between Black Sea and Golden Drop made by Cyrus G. Pringle, of Charlotte, Vt., in 1870. Many years after being distributed it was commercially grown in the western United States. It is now grown chiefly under irrigation in Yellowstone County, Mont., and Park County, Wyo. In these localities, however, it is of less importance than Marquis.

In experiments Champlain has given comparatively high yields under irrigation in southeastern Montana and western South Dakota. It is evidently a little better yielder than Marquis in these sections when grown under irrigation. As Champlain has a softer kernel than the leading varieties of hard red spring wheat, it is inferior to them in milling and baking qualities.

DIXON.

Dixon (known also as Smooth Humpback and Humpback II) is taller and later and has larger heads and kernels than Preston. The kernels are softer, have a longer brush (tuft of hairs at the upper end), and have a shape commonly described as "humpbacked." The outer chaff has no notch, or shoulder, at the upper end.

The origin of Dixon is not known. Johnson wheat, mentioned in the history of the Preston and Java varieties, contains forms of wheat identical with Dixon. This wheat is grown in Wisconsin to a limited extent under the name Dixon, but a variety previously known as Smooth Humpback, or Humpback II, which is practically identical with Dixon and has been given that name, is considerably grown in Minnesota and Nebraska. This latter wheat originated from field selections made by J. P. Berglund, of Kensington, Minn. Two strains were developed and distributed, one having velvety chaff, described later as Humpback, and the other having glabrous chaff (not velvety), here called Dixon. The Dixon wheat has given comparatively low yields of grain in most experiments, and as its baking quality is very inferior it should not be continued in cultivation. The prices received for this wheat on the market usually are much less than for other hard red spring wheats.

FRETES.

Fretes differs from Preston in having larger heads and larger pale-red, rather soft kernels. The beaks (from $\frac{1}{8}$ to $\frac{3}{4}$ inch in length) are much longer than those of Preston. The straw is weak and allows the wheat to lodge on rich soils or in wet seasons.

Fretes was introduced into the United States from El-Outaya, Constantine, Algeria, in 1901 by the U. S. Department of Agriculture. The variety is said to have originated from a shipment of Russian wheat which was made into Algeria at the time of a famine many years ago. This variety was distributed in California and, as far as known, is now grown in the United States only in Los Angeles County, Calif. It is quite drought resistant and in experiments has given good yields in several dry sections of the United States. Owing to its weak straw it is not likely to become commercially important, however. The kernels of Fretes are somewhat softer than those of the varieties of hard red spring wheat grown in the northern spring-wheat region and are inferior to most of them in milling and baking quality.

CHUL.

Chul (known also as Anlieata, Idaho Hard, and Yantagbay) is distinct from other varieties discussed in this section in having very open heads and very large and very hard kernels. The latter re-

semble those of durum wheat but are mostly of a deep-red color. The beaks of Chul are sometimes more than $1\frac{1}{2}$ inches in length. The straw is very weak and the plants lodge easily.

Chul was introduced into the United States in 1902 from Russian Turkestan by the U. S. Department of Agriculture. It is grown there on the steppes without irrigation and is both fall and spring sown. Chul as introduced and distributed was mixed with a white-kerneled wheat called Talimka, which is identical with Chul in all other characters. Chul was distributed in the dry sections of California, and the variety is now grown to a slight extent in northern California and in one county in Nevada. In the early experiments Chul gave some promising yields, but in the better wheat-growing sections it was not equal to the leading varieties already grown, nor is it equal to other varieties more recently introduced. The weak straw of Chul has prevented its more general culture. Although the kernel of this variety is extremely hard and contains a good percentage of protein, it is an inferior wheat for bread-making purposes. The Chul wheat now grown is not ground into flour. In view of its serious defects the growing of this variety should be entirely discontinued.

SECTION 4.—HEADS BEARDED; CHAFF GLABROUS (NOT VELVETY), BROWN OR RED.

The varieties included in section 4 are midearly in ripening, maturing about the same time as or somewhat earlier than Preston. Several varieties (Huron, Laramie, Manchuria, and Norka) properly included in this section have been grown in station experiments, but only one variety, the Ladoga, is commercially grown in the United States and therefore is the only variety discussed.

LADOGA.

Ladoga (known also as Spring Turkey and Bastard) is mostly of the type mentioned above, but as commercially grown it contains mixtures of several other forms. Ladoga is slightly earlier than Preston and is very susceptible to stem rust. The kernel of Ladoga, although somewhat smaller, resembles that of Turkey, a hard red winter wheat, and being also bearded like the latter variety it is known on the farms as Spring Turkey.

Ladoga wheat was introduced into Canada about 1888 from Russia, where it was grown in latitude 60° near Lake Ladoga, north of Petrograd. Because of its earliness it was distributed by the Canadian Department of Agriculture into northwestern Canada during the next five years, but by 1893 was found to be of poor milling quality and its further production was discouraged. It is not known when or by whom this variety was introduced into the United

States, but it is grown on both dry and irrigated lands in Colorado, Kansas, Montana, Nebraska, and Wyoming. It is not an important variety in any of these States.

The yields from Ladoga in comparative experiments have been lower than those from nearly all other varieties of hard red spring wheat. It was early discovered that Ladoga was inferior to Red Fife in milling and baking qualities. This wheat, therefore, should be entirely replaced by other varieties.

SECTION 5.—HEADS BEARDED; CHAFF VELVETY, WHITE OR YELLOW.

This section includes two rather unimportant varieties which differ widely in characters and in adaptation.

PRELUDE.

Prelude (Wisconsin Wonder) is extremely early, maturing from 7 to 10 days earlier than Marquis, and has short stems, heads, and kernels. The beards also are short, are dark brown or black when ripe, and the chaff is covered with short, fine, white hairs. (Fig. 11, A.) The heads shatter very easily when fully ripe, so the variety must be harvested while still somewhat green. The kernels of Prelude are of a dark-red color and have a very short brush.

Prelude was originated by Dr. C. E. Saunders, Cerealist of the Dominion Department of Agriculture, at the Central Experimental Farm, Ottawa, Canada. It resulted from a cross made in 1903 between the Fraser and Gehun varieties. Fraser was also of hybrid origin and was produced at Ottawa, while Gehun was introduced from India. Prelude was first distributed in Canada in 1913. It was introduced into the United States by the U. S. Department of Agriculture for experimental purposes in 1915. About 1910 H. E. Krueger, of Beaverdam, Wis., found a plant of Prelude in a field of Marquis. This he increased and distributed as Wisconsin Wonder, and Prelude now is grown to a limited extent under that name in Wisconsin and Minnesota.

Prelude is quite well adapted to the northern wheat sections of Canada, for which it was originated because of the very short growing season, but in the United States it is too early to produce maximum yields. Under favorable conditions this wheat is usually outyielded from 20 to 50 per cent by Marquis or other varieties. Its earliness has sometimes enabled it to escape summer drought or hot winds and give fairly good yields in seasons which were very unfavorable for later maturing varieties. In a few dry seasons in the Great Plains section of Colorado and Nebraska Prelude has outyielded all other hard red spring-wheat varieties. On the average, however, even in these sections, Prelude is outyielded by Marquis and several

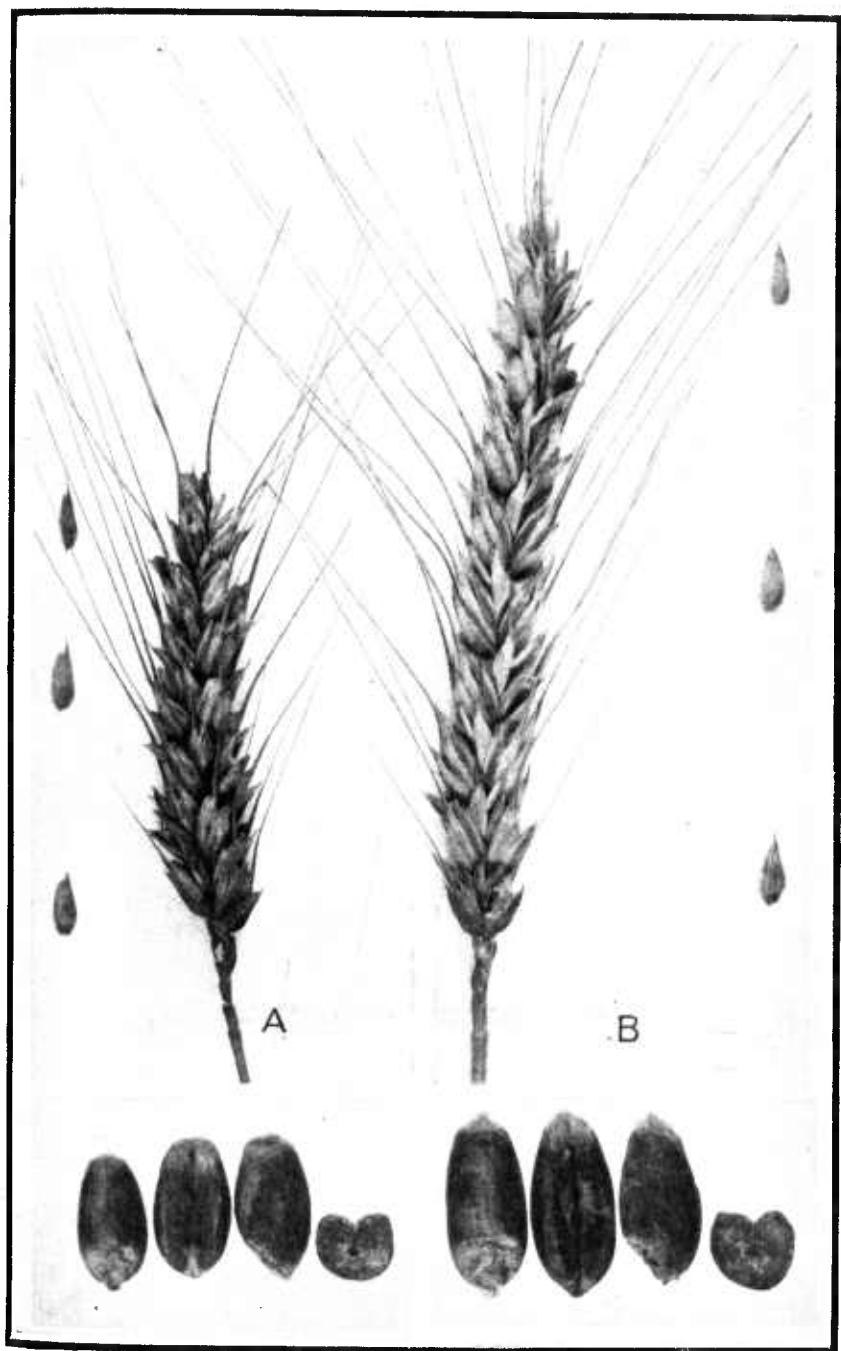


FIG. 11.—Heads, chaff, and kernels of Prelude (A) and Humpback (B) wheats. Heads and chaff, natural size; kernels, magnified 3 diameters.

other varieties. These sections also are better adapted to hard winter and durum spring wheats than to hard red spring varieties. Prelude is not now and should not become an important spring wheat in the United States, both on account of its low average yield and its easy shattering. Prelude is almost equal to Marquis in milling and baking qualities and is fully equal to any variety other than Marquis.

HUMPBACK.

Humpback (known also as Bearded Bluestem and World Beater) has bearded, velvety, white-chaffed heads like Prelude, but the heads are long, wide, and open and the plant is late in maturing. (Fig. 11, *B*.) The kernels are softer than those of most of the hard red spring varieties and are large and pale red, with a long, large brush and a shape commonly described as humped. The crease of the grain has a deep pit or opening in the middle.

Humpback originated from field selections made by J. P. Berglund, a farmer living near Kensington, Minn. The original head probably was the result of a natural field hybrid. Two strains were developed. The first, which was distributed about 1905, became known as Humpback, and the second, which was distributed a few years later but which differs in having glabrous (not velvety) chaff, has been described previously as Dixon. Humpback is grown sparingly in Illinois, Minnesota, Nebraska, North Dakota, South Dakota, and Wisconsin. It is not grown as extensively now as it was a few years ago.

In all comparative experiments Humpback has given low yields. It matures too late to avoid rust and drought and is not a high-yielding wheat under favorable conditions. It also has inferior milling and baking qualities, and because of this it always brings a low price on the market. The growing of Humpback, therefore, should be discontinued.

